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PASTEUR.

The Life of Pasteur. By René Vallery-Radot. Translated from the French by Mrs. R. L Devonshire. Pp. 628; 2 vols. (Westminster: Archibald Constable and Co., Ltd., 1902.) Price 32*s*.

"L'ŒUVRE de Pasteur est admirable; elle montre son génie, mais il faut avoir vécu dans son intimité pour connaître toute la bonté de son cœur," wrote one of Pasteur's most distinguished disciples who was in daily intercourse with him.

This sentiment, so simply and so eloquently expressed by Dr. Roux, can now, thanks to M. Vallery-Radot, be shared by that larger circle of Pasteur's friends and admirers who, distributed in all quarters of the globe, knew him in his public capacity, but could not have the privilege of being included amongst his intimate associates.

There are, however, few men whose scientific writings reflect the inner life of the man to the same extent as do those of Pasteur, for with Pasteur his work was his life—his religion, and it was inseparably bound up with every action, with every aspiration.

M. Vallery-Radot has enabled us to accompany Pasteur throughout his career, to share alike in his joys and his sorrows, in his anxieties and triumphs, guiding and directing us the while with consummate skill, so that the true proportion of the actions and events which are recorded is maintained in their relation to the whole. As Pasteur's son-in-law, M. Radot has had exceptional opportunities for undertaking this biography, and already we are familiar with his workmanship in that vivid sketch of Pasteur published many years ago, in which the authorship is modestly veiled under the title "l'histoire d'un savant par un ignorant." This little volume was brought out in Pasteur's life-time; since his death we have had M. Duclaux's intellectual appreciation of his master, whom he succeeded as Director of the Pasteur Institute, Dr. Roux's sympathetic personal reminiscences of his great teacher, M. Fleury's impressionist sketch, and in England the volume in the Century Science Series, for which the writer of this notice and her husband are responsible. M. Radot's work differs from all of these inasmuch as he has had access to letters and diaries, note-books and divers documents which were to others inaccessible, and by the judicious use of which the personal element is so happily brought into relief and yet blended so harmoniously with its surroundings.

Of no man could it be more truly said that whatsoever his hand found to do he did it with all his might; the *de minimis non curat* did not exist for Pasteur. As Dean of the new Faculté des Sciences at Lille, for example, despite his passionate devotion to his researches on crystals and molecular dissymmetry, he would forsake his beloved laboratory to take his students round factories and foundries, even organising a tour in Belgium so that they might visit the industries of the country, "questioning the foreman with his insatiable curiosity, pleased to induce in his students a desire to learn."

Later, when he returns to the École Normale as administrator and director of scientific studies, in which office was included such miscellaneous duties as the surveillance of the economic and hygienic management, the responsibility for general discipline, intercourse with the families of the pupils and the literary or scientific establishments frequented by them, we find him noting down as matters for attention "Catering; ascertain what weight of meat per pupil is given at the École Polytechnique. Courtyard to be strewn with sand. Ventilation of class room. Dining hall door to be repaired."

If professors in this country have in the past had but slight encouragement to embark upon research, what would they have said to the position of Pasteur in this respect, who at the École Normale, in addition to such vexatious demands upon his valuable time, had no laboratory, but a garret only in which to carry on his investigations, whilst we hear of him later "building a drying-stove under the staircase; though he could only reach the stove by crawling on his knees, this being better even than his old attic"?

The general state of affairs connected with higher education in France was indeed at that time most deplorable, and Duruy, the enlightened Minister of Public Instruction, whilst sympathising with the lamentable position occupied by science in the country and deeply regretting the penurious policy which stifled its aspirations, was unable to make his voice heard in Cabinet councils, the other ministers, we are told by him, "being absorbed in politics."

Pasteur and Duruy had often discussed the contrast presented by the flourishing young University of Bonn, with its staff of fifty-three professors and vast laboratories for chemistry, physics and medicine, and the Strassburg faculty, with its handful of teachers, hampered in every direction by a policy of deplorable penury. It is not surprising to find Pasteur, in the anguish of his soul, well-nigh crushed by the disasters which overwhelmed his country, bitterly exclaiming in 1870:

> "We savants were indeed right when we deplored the poverty of the department of Public Instruction! The real cause of our misfortune lies there. It is not with impunity—as it will one day be recognised, too late—that a great nation is allowed to lose its intellectual standard. . . . We are paying the penalty of fifty years' forgetfulness of science, of its conditions of development, of its immense influence on the destiny of a great people, and of all that might have assisted the diffusion of light."

Again he writes in a pamphlet entitled "Why France found no Superior Men in the Hours of Peril":—

> "France has done nothing to keep up, to propagate and to develop the progress of science in our country. . . . She has lived on her past, thinking herself great by the scientific discoveries to which she owed her material prosperity, but not perceiving that she was imprudently allowing the sources of those discoveries to become dry . . . Whilst Germany was multiplying her universities, establishing between them the most salutary emulation, bestowing honours and consideration on the masters and doctors, creating vast laboratories amply supplied with the most perfect instruments, France, enervated by revolutions, ever vainly seeking for the best form of Government, was giving but careless attention to her establishments for higher education."

This crying need of a people was voiced by Pasteur more than thirty years ago, at a time when great national disasters were sweeping all before them; a quarter of a century later these words sound a prophetic note of warning to another nation which, with similar arrogance and similar criminal neglect, has made a fetish of political illusions whilst the very foundations upon which the soul of the people depends have been forgotten or deliberately ignored.

"Is it not deplorable, almost scandalous," exclaims the Minister Duruy, "that the official world should be so indifferent on questions of science?" Would that England had a minister who, whilst sharing such a conviction, possessed the courage to express it! Pasteur with rare prescience was never weary of insisting upon the importance of higher education; "if that teaching is but for a small number, it is with this small number, this *élite*, that the prosperity, glory and supremacy of a nation rest," and we find him again and again returning to the same theme.

M. Radot takes us step by step along the victorious path which Pasteur cleared in the conquest of the most difficult scientific problems of the day. Yet he reminds us that those imaginative people

> "who would decorate the early years of Louis Pasteur with wonderful legends would be disappointed; . . . at the Arbois College he belonged merely to the category of good average pupils . . . at the examination for the *baccalauréat ès sciences* he was only put down as *médiocre* in chemistry."

But all this was to be changed, and under the inspiring influence of two such teachers as Balard and Dumas he became a student of chemistry second to none in the enthusiasm for his subject.

His discoveries in crystallography soon won for him a foremost place in the scientific world. In a letter from the great physicist Biot to Pasteur's father we have a charming tribute paid by the aged to the young philosopher.

> "It is the greatest pleasure that I can experience in my old age to see young men of talent working industriously, and trying to progress in a scientific career by means of steady and persevering labour and not by wretched intriguing. That is what has made your son dear to me, and his affection for me adds yet to his other claims and increases that which I feel for him."

Biot's friendship for Pasteur, which ripened into a fatherly love and pride in his work, only terminated with his death and was one of Pasteur's most valued possessions.

It will be remembered how Mitscherlich had discovered that the two tartaric acids so familiar to chemists, while apparently identical in chemical composition, in chemical properties, in crystalline form and, in fact, in every known detail, behaved differently in solution towards polarised light. This distinguished crystallographer, unable to detect any difference in these two tartrates, asserted that they were identical in every other particular. Pasteur could not accept this conclusion as to the absolute identity of these substances in face of the fact of their different behaviour towards polarised light, and determined, if possible, to procure some of the inactive tartaric or racemic acid and submit it to an exhaustive examination. But how to procure this racemic acid? Originally obtained in 1820 by Kestner, at Thaun, through a mere accident in the manufacture of tartaric acid, it had suddenly ceased to appear in spite of all efforts to obtain it again. Pasteur's emotion was immense on hearing from Mitscherlich that a manufacturer in Saxony had again produced some racemic acid, and that he believed the tartars employed had originally come from Trieste. "I shall go to Trieste," says Pasteur, in a fever of excitement; "I shall go to the end of the world. I *must* discover the source of racemic acid, I must follow up the tartars to their origin."

Armed with letters of introduction, he starts off on his voyage of discovery and, writes a contemporary, "never was treasure sought, never adored beauty pursued over hill and vale with greater ardour."

How he succeeded in obtaining specimens and in establishing a minute difference in the crystalline structure of these two acids, overlooked by the renowned and experienced Mitscherlich, and how his fundamental discovery of the relationship which exists between crystalline form and optical activity, followed up by a series of masterly investigations, has given birth to that fertile offshoot of chemical science known as stereochemistry, is familiar to all.

The red ribbon of the Legion of Honour was his country's recognition of these brilliant discoveries in the field of chemical science. In the further prosecution of his investigations, Pasteur discovered that if he allowed one of the salts of racemic acid to ferment, the dextro-tartaric component was alone acted upon, which action in his own words he declares to be "the ferments of that fermentation feeding more easily on the right than the left molecules." At this time, when his attention was being arrested by the problems of fermentation in connection with the production of chemical compounds, he was appointed professor at Lille. Difficulties encountered by a local manufacturer in the production of beetroot alcohol induced Pasteur to turn his thoughts more especially to the phenomena of fermentation, and these studies led by a natural sequence to his throwing down the gauntlet to the great Liebig and entering single-handed upon that famous contest with the most brilliant intellects of the day as to the origin of the phenomena of putrefaction and decay.

The current contempt for Pasteur's conclusions may be realised from the following words emanating from the most distinguished chemist of the day. In 1845 Liebig wrote:—

> "As to the opinion which explains putrefaction of animal substances by the presence of microscopic animalculæ, it may be compared to that of a child who would explain the rapidity of the Rhine current by attributing it to the violent movement of the numerous mill-wheels of Mayence."

Pasteur relates how, several years later, he visited Liebig in his laboratory, anxious to induce him to acknowledge the truth of his theories; he was received with kindly courtesy, but on endeavouring to approach the delicate subject he had so much at heart, Liebig, "without losing his amenity, refused all discussion, alleging indisposition."

The multiplicity and varied character of Pasteur's researches have been well-nigh forgotten by a generation which almost exclusively associates his name with the work of his later years—rabies and its prevention. His researches on vinegar, on the diseases of wine, his laborious investigations extending over years which succeeded in disclosing the origin of the diseases in silkworms which had threatened to ruin the silk industry of France, his studies on beer, collected in a magnificent volume covering nearly 400 octavo pages, are but a few of the colossal labours which occupied his mind before he became absorbed in the study of contagious diseases.

At the ripe age of fifty-five we find him devoting himself with all the energy and enthusiasm of youth to the study of pathological phenomena. Various theories as to the origin of anthrax were in the air at the time when Pasteur determined to enter the field. M. Radot gives a most vivid account of these researches and of the hopes and anxieties to which Pasteur was a prey at this time, living as he did in a condition of intense nervous tension and excitement during their progress. Difficulties, however, never deterred, they only served to stimulate, Pasteur. The memoir in which Pasteur and his assistants communicated their successful investigations on anthrax and septicæmia to the Academy of Sciences is famous, not only on account of the manner in which they mastered the etiology of these diseases, but also for the extreme fertility and originality of the ideas and experiments which it records. Having established the identity of the virus he set to work to discover a means of combating its action, and thus he was led to those epoch-making researches in the domain of immunity which were to succeed in converting a virus into a vaccine—a malignant foe into a beneficent friend—and which have made the name of Pasteur a household word revered in the remotest corners of the globe.

M. Radot, besides giving us a faithful and fascinating history of Pasteur's scientific life and aspirations, has with the delicate touch of a master revealed the inner life of this great genius, with rare subtlety indicating the essential character of the man who,

> "absorbed as he was in his daily task, yet carried within himself a constant aspiration towards the ideal, a deep conviction of the reality of the infinite and a trustful acquiescence in the mystery of the universe."

No one who reads Pasteur's speeches can fail to be struck by the lofty tone which pervades them; he sought always the highest and scorned to touch what was base; his deep religious sense communicated itself to all who were brought in contact with him, from the most exalted in the land to the poorest student who came to work under his guidance.

In one of those public utterances which in his declining years became so rare and so eagerly sought for he tells us:

> "Our only consolation, as we feel our own strength failing us, is the consciousness that we may help those who come after us to do more and to do better than ourselves, fixing their eyes as they can on the great horizons of which we only had a glimpse."

This is the keynote to his life, embodying the same passionate desire to help others which stimulated him from his earliest years, but mellowed by the ripeness of advancing age, and the consciousness of a life fast drawing to a close, the burden of which was soon to be laid aside.

G. C. Frankland.

A MANUAL OF MEDICINE.

A Manual of Medicine. Edited by W. H. Allchin, M.D., F.R.C.P. Lond., F.R.S. Edin., Senior Physician and Lecturer on Clinical Medicine, Westminster Hospital. Vol. iii. *Diseases of the Nervous System.* Pp. x + 417. (London: Macmillan and Co., Ltd., 1901.) Price 7*s*. 6*d*. net.

THE third volume of Dr. Allchin's "Manual of Medicine" is well up to the standard of its predecessors, in fact, if anything, may be regarded as rather exceeding it. Here, in 417 short pages, the student of medicine has at his command a complete and up-to-date book upon that ever-increasing domain of medicine, nervous disease. The difficulty of editing must in this volume almost have reached its maximum. When we come to consider the enormous mass of literature which has accumulated since even the publication of the last standard book upon this subject, we may perhaps appreciate the great difficulty of compressing our compendious knowledge upon nervous disease into what may, without forcing language, be called a manual. In these circumstances we can hardly expect theories to be discussed *in extenso*, or ample polemic justice to be done to controversial matter. The book is filled with terse fact, and if its readability suffers somewhat on this account, its value to the student is proportionally increased.

With the space at our command we must content ourselves with indicating rather than describing the contents of the book. Even to those out of touch with the burning problems of nervous disease, and only generally interested with the physiology of the nervous system as a part of biology, it will be manifest that the recent progress in histological method, the product of increased knowledge of bio-chemistry, has profoundly modified our conceptions of the constitution of the nervous system and also neuro-pathology.

In an introductory chapter Prof. Sherrington deals with the physiology of the nervous system in a most lucid and wonderfully succinct manner. This chapter is followed by one contributed by Dr. Aldren Turner upon the general pathology of the nervous system. Dr. Turner points out that the adoption of the conception that the nervous system consists of a series of neurons necessarily precludes us from continuing to divide affections of the nervous system above the foramen magnum from those below. The only true system of classification must be one based upon the neuronic systems primarily involved. It must, however, be admitted that a given morbid process need not necessarily confine itself to one neuronic system, but may simultaneously implicate two or more. Several other articles are contributed by the same author. The one on focal diagnosis is especially to be recommended.

With the beer-poisoning epidemic fresh in our memory we naturally turn to the article on peripheral neuritis, which is written by Dr. Purves Stewart. The different varieties of neuritis are well described, the author wisely abstaining from controversial matter. Dr. Ormerod contributes articles upon the spinal cord and its membranes and the muscular dystrophies.

The volume concludes with a most instructive and